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Original Article

Antimicrobial efficacy of spray disinfectants on dental impressions.

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Abstract

The objective of the study was to evaluate the efficacy of 0.5 % Sodium hypochlorite and 2% Glutaraldehyde spray disinfectants on Impression compound and Irreversible hydrocolloid impressions.

Methods:

Twenty edentulous patients with the age group of 45 – 65 years were randomly selected for the present study. Maxillary and mandibular impressions of 10 patients were taken in impression compound and for remaining 10 in alginate.Out of all 40 impressions, each was swabbed and incubated on nutrient agar culture media. This constituted the control group. Twenty maxillary and mandibular compound impressions were divided into two groups of 10 each. Samples of each group were sprayed with 0.5 % Sodium hypochlorite and 2% glutaraldehyde respectively. Twenty alginate impressions received the similar disinfection treatment. After 10 minutes the impressions were reswabbed and incubated for 24 – 48 hours and microbial colony count was carried out.

Results:

It was observed that there was presence of numerous bacteria both gram positive and gram negative, on Compound and Irreversible hydrocolloid impressions taken from edentulous patients. Both these disinfectant were found to be highly effective as 90- 100% bacteria could be eliminated.

Conclusions:

Within the limitations of the study it was concluded that 2% Glutaraldehyde and 0.5% Sodium hypochlorite was statistically equally effective both against gram positive and gram negative organisms. Sodium hypochlorite 0.5% was found to be marginally more effective than 2% glutaraldehyde on Irreversible hydrocolloid.

Key words

Impression compound, Irreversible hydrocolloid, Glutaraldehyde, Sodium hypochlorite, Spray disinfectants.

INTRODUCTION

Prosthodontic patients are generally a high risk group relative to their potential to transmit infectious diseases as well as acquire them. There has been a recent increased awareness of the need for cross infection control measures to protect against possible routes of transmission frequently ignored in the past. Cross contamination control measures are considered within several categories such as Patient evaluation, Personal protection, Instrument and equipment contamination, Clinical technique, Impression handling and Laboratory asepsis.1 It was in the 1980s a new era in field of dentistry, where cross infection control, chemical hazards, communications and infectious waste management was highlighted to signify a great change in clinical practice2. In dentistry all the clinical procedures are undertaken in an environment in which there is saliva and blood contaminated with micro-organisms. The standard procedure of rinsing impressions under running tap water immediately after removal from the mouth prevents only a gross removal of contamination with saliva and blood and does not completely eliminate all microorganisms. Surface disinfection to inactivate infectious agents is highly desirable to reduce the potential transmission of disease to dental personnel from contaminated impressions.3 A number of professional organizations have issued recommendations for cross infection control, but there is an inadequate implementation regarding the ease with which the oral micro-organisms can be removed by disinfectants from impression material and cast. 4, 5

To prevent cross contamination during clinical and laboratory procedures between patients, operator and technicians, several new products are being continuously developed. Among these 0.5% Sodium hypochlorite and 2% Glutaraldehyde have been considered effective. Spray disinfectants are preferred, as dimensional changes in the alginate impression material are seen when immersion disinfectants are used.6 Earlier studies have been made to ascertain the antimicrobial properties of 0.5% sodium hypochlorite on irreversible hydrocolloid impression material.3,7,8,9,10 A few of the studies have been done to assess the antiviral properties of 0.5% sodium hypochlorite and 2% glutaraldehyde on irreversible hydrocolloid impression material11. There is no comparative study to evaluate the antimicrobial effectiveness between 0.5% sodium hypochlorite and 2% glutaraldehyde on irreversible hydrocolloid. Further, most of the disinfectant studies conducted on irreversible hydrocolloid impressions were obtained from typhodont models, which were later kept in an

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artificial salivary broth. Hence, this in vitro study was conducted to find out the effectiveness of two disinfectants against microorganisms on the impression compound and irreversible hydrocolloid impressions.

METHODS:

Twenty edentulous patients with the age group of 45-65 years were randomly selected for the study. A short medical history was taken and a thorough oral examination was carried out to exclude the presence of local or systemic disorders.Selection was based on the consent of patient to participate. Impression compound (DPI Pinnacle, Dental Products of India, Mumbai) and an irreversible hydrocolloid impression material (Alginate- Zelgan 2002, Dentsply India pvt. ltd., Gurgaon) were used to take the impression of the patients. The spray disinfectants used in the study were; 0.5 % Sodium hypochlorite (Organo biotech industries Calcutta) and 2% Glutaraldehyde (Johnson & John- son of India, Ltd.,Bombay). Prior to taking the impressions all the patients were asked to rinse once with water. Suitable stock metal tray was used for the impression. Total 40 impressions of maxillary and mandibular ridges were taken out in 20 patients, which were initially divided into two groups of each containing 20 impressions:Group A – 10 maxillary and 10 mandibular impressions taken in Impression compound. Group B – 10 maxillary and 10 mandibular impressions taken in Alginate.

After removal from the mouth the impression was washed with running tap water for 15 second to remove excess saliva. Prior to disinfection, the impression that was used for the study constituted the control group and the same was used as test group after disinfection. For this purpose, each of the impression was numbered on back of it.

Pre Disinfection Microbial colony count

For this purpose the surface of each of the impression was swabbed with dry sterile cotton swab for 30sec (figure 1).The swab was then immediately applied to nutrient agar culture media for microbiological sampling (figure 2). The swab of each of the 40 samples was incubated aerobically at 37°C for 24-hours and also incubated for micro-aerophyllic condition by providing 5-10% CO2. Then the microbial colony count was carried out accordingly and findings were recorded (figure 3).

Disinfection procedure

Group A and B impressions were reused in disinfection procedure, which were further divided into four groups, each comprised five maxillary and five mandibular impressions:Group A1 – included 10 impressions of Impression compound, sprayed with 0.5 % Sodium hypochlorite spray disinfectant.

Group A2 - included 10 impressions of Impression compound, which were sprayed with 2% Glutaraldehyde.
Group B1 – included 10 alginate impressions, disinfected with 0.5 % Sodium hypochlorite spray disinfectant.
Group B2 – included 10 alginate impressions, disinfected with 2 % Glutaraldehyde.
It was insured that even distribution of disinfectant occurred and no area was left uncovered. After disinfection, each of the impression was kept in air tight polythene bag for 10 minutes.

Post Disinfection Microbial Colony recount

After a period of 10 minutes, each of the impression was removed from the polythene bag and again swabbed with dry sterile cotton swab for 30sec. The swab was applied to nutrient agar culture media for microbial sampling and incubated for 24-48 hours (figure 4). The microbial colony count was then carried out (figure 5, 6, 7). All the 40 impressions were treated in similar manner. The results were recorded, analyzed and compared with the control and were subjected to statistical analysis.

RESULTS:

The disinfectant effect of 0.5% Sodium Hypochlorite and 2% glutaraldehyde on gram positive and gram-negative bacteria on impression compound and alginate impressions, before and after disinfection is shown in table 1 and 2. In case of impression compound, colony count before disinfection with 0.5% sodium hypochlorite spray was 104 CFU/ML (Colony Forming Unit) for gram positive organisms and for gram negative it was 103 CFU/ML. After disinfection the colony count was reduced to 0 CFU/ML for gram positive organisms and for gram negative it was 0.5×101 CFU/ML. Colony count before disinfection with 2% glutaraldehyde spray for gram positive organisms and gram negative organisms was 104 - 105 CFU/ML and after disinfection the colony count was reduced to 102 CFU/ML for gram positive and gram negative organisms.

However in case of alginate, colony count before disinfection with 0.5% sodium hypochlorite spray was 105 CFU/ML for gram positive and 104 CFU/ML for gram negative organisms, and after disinfection the colony count was reduced to 0 CFU/ML for gram positive organisms and for gram negative it was 101 CFU/ML. Colony count before disinfection with 2% glutaraldehyde spray for Gram positive organisms and gram negative organisms was 104 CFU/ML and after disinfection, the colony count was reduced to 102 CFU/ML for gram positive organisms and 0.55×102 CFU/ML for gram negative organisms.

DISCUSSION:

Minimizing the risk of disease transmission in the dental workplace has today become a high priority for the dental profession. Contaminated materials are routinely sent to dental laboratories thus creating an occupational hazard.Microbial contamination of dental materials and prosthesis has been documented by the work of Wakefeld et al12. Such pathogenic contaminants include bacteria such as E.coli, Staphylococcus aureus, Streptococcus mutans, Yeast and Candida albicans. In one study Samaranayake et al 13 found the coliforms organism E.coli and fungus C.albicans to be more persistent on impression materials than Staphylococcus aureus or Streptococcus mutans. A routine procedure of disinfection should be done on primary and secondary impressions to reduce the risk of contamination of the casts. Casts which are not disinfected carry the virus, micro-organisms from the oral cavity and some of them survive for longer periods. The dentists, their assistants, and technicians face the hazard of getting infected from some of the pathogenic organisms contained on the cast. Therefore, there is a need to effectively disinfect these impressions. 14
The present study was carried to evaluate the efficacy of 0.5% Sodium hypochlorite and 2% Glutaraldehyde disinfectants on edentulous impressions. These disinfectants were used to spray the impression in an even manner to coat the impression surface. These disinfectants have been shown to be most effective amongst other disinfectants as reported by Storer and Mc Cabe.15 Swabs for culture taken before and after the disinfection were inoculated on culture media nutrient agar to see the growth of gram positive and gram negative organism. This bacteriological investigation was done to assess the growth of bacterial colonies and their species. These disinfectants can be used either in form of immersion or as spray disinfectant. Immersion disinfectant though effective, they are not as satisfactory as spray, considering their adverse effect on the dimensional stability. Spray disinfectants are therefore superior and produce good disinfection.

Considering this, spray disinfectants were selected to study their antimicrobial effect.

Among the two impression materials used for edentulous impression, it has been reported that Irreversible hydrocolloid material has an intrinsic retentive potential for microbes as compared to impression compound materials and is therefore potentially more difficult to disinfect. It has been reported by Samaraayanke et al13 that Irreversible hydrocolloid impression carry three to four times more organisms than impression compound. This is yet another reason for including Irreversible hydrocolloid in this study. A few of the earlier investigators have studied the disinfection of irreversible hydrocolloid impression by an indirect method of taking hydrocolloid impression in a typhodont and later exposing the impression to an artificial saliva broth containing selected groups of bacteria after rinsing the impression in running water.14 Swabs were then made and inoculated in culture media. It is felt that a direct study involving the microorganisms carried on the impressions from the oral cavity will be more accurate to assess the efficacy of disinfectants. Therefore in the present study a direct method was preferred. The subjects were randomly selected and the impressions were made which were later disinfected with 0.5% Sodium hypochlorite and 2% Glutaraldehyde.

The data collected was based on the colony forming units in the culture media .These were counted with colonycounter and the counts were expressed under the standard method of recording microbial colony count (CFU COUNT).The bacteriological investigation clearly demonstrated that the colony forming units recovered before disinfection were much greater than after disinfection. It was also seen that both 0.5% Sodium hypochlorite and 2% Glutaraldehyde solution were more effective on gram positive organisms such as Streptococcus mutans, Viridians, Peptostreptococcus than gram negative organisma such as Prevotella, Pseudomonas, Klebsiella. Sodium hypochlorite 0.5% was marginally more effective than 2% Glutaraldehyde on gram positive as well as gram negative organisms.

The results of this study clearly indicated that both the disinfectants revealed a statistically significant difference as compared to controls, both in case of compound impressions as well as alginate impressions. This is based on the fact that the disinfection efficacy ranged between 92% - 99.97% considering all the situations.

One of the significant findings of the study was the isolation of Clostridium Tetani 104 CFU/ML in the Impression compound impression of one of the subjects before disinfection. It was completely eradicated after disinfection with 0.5% Sodium hypochlorite. Thus the presence of Cl. Tetani in one of the impressions, even though statistically insignificant and of low incidence, its presence is very alarming and lays emphasis on disinfection of impressions in routine dental practice. Though most of the organisms cultured were commensals and grouped as non-pathogenic, they might be able to cause cross infection if their virulence and number is high or the resistance of host is compromised. This study was carried out on edentulous patients. It was presumed that dentulous patient and those having any oro- dental pathology have the potential to transmit the infection to dental personnel. This study showed the importance of disinfecting the impressions as a precautionary measure in order to prevent cross infection in the dental clinic and the dental laboratory.

CONCLUSIONS:

Within the limitations of the study, following conclusions were drawn:

1. The antimicrobial activity of spray disinfectants - 2% Glutaraldehyde and 0.5% Sodium hypochlorite was found statistically to be equally effective both against gram positive and gram negative organisms.
2. Sodium hypochlorite 0.5% was marginally more effective than 2% Glutaraldehyde on alginate impression material.
3. Both the disinfectants were found to be equally effective on impression compound.
4. Sodium hypochlorite 0.5% is more effective on alginate impression material as compared to impression compound.

Hence, routine disinfection of impressions using either of the disinfectant is preferred to prevent cross infection in dental practice.

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Table - 1
Comparative evaluation of 0.5% sodium hypochlorite and 2% glutaraldehyde - before and after disinfection on impression compound impressions

Impression compound impressions

Group	Condition	Type of organisms									
		Colonies of gram positive organisms					Colonies of gram negative organisms				
		Minimum	Maximum	Median	Mean	Standard deviation	Minimum	Maximum	Median	Mean	Standard Deviation
A	Pre Disinfection	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A1	After Disinfection	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	Pre Disinfection	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A2	After Disinfection	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Foot Note: Group A1: 0.5% Sodium hypochlorite
Group A2: 2 % Glutaraldehyde

Table - 2
Comparative evaluation of 0.5% sodium hypochlorite and 2% glutaraldehyde - before and after disinfection on

Group	Condition	Type of organisms									
		Colonies of gram positive organisms					Colonies of gram negative organisms				
		Minimum	Maximum	Median	Mean	Standard deviation	Minimum	Maximum	Median	Mean	Standard Deviation
B	Pre Disinfection	1000.00	100000.00	100000.0	72100	44990	0.00	100000.00	10000.00	15210	30163.57
B1	After Disinfection	0.00	100.00	0.00	30	48.30	0.00	100.00	10.0	43	49.22
B	Pre Disinfection	1000.00	100000.00	10000.00	35200	44859.78	0.00	10000.00	10000.00	17000	29458.07
B2	After Disinfection	0.00	100.00	100.00	72.00	45.16	0.00	1000.00	55.00	143	304.74

alginate impressions

Foot Note: Group B1: 0.5% Sodium hypochlorite
Group B2: 2 % Glutaraldehyde

FIGURE LEGENDS:

Figure 1- Collecting swab from impression
Figure 2- Colonial growth before Disinfection of impression
Figure 3- Micro organisms Colony counter
Figure 4- Colonial growth after disinfection
Figure 5- Colony forming units as seen through Colony counter
Figure 6- Colonies of Gram – ve bacteria
Figure 7- Colonies of Gram + ve bacteria

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